Original Article

Risk factors for postoperative cerebral infarction in patients after lung resection: a single-center case-control study

Shenhu Gao[1], Yuwei Zhou[1], Rong Yang[2], Chengli Du[1], Yihe Wu[1]

[1]Department of Thoracic Surgery, The First Affiliated Hospital, Zhejiang University School of Medicine, Hangzhou, China; [2]Department of Radiology, The First Affiliated Hospital, Zhejiang University School of Medicine, Hangzhou, China

Contributions: (I) Conception and design: Y Wu; (II) Administrative support: Y Wu; (III) Provision of study materials or patients: S Gao, Y Wu; (IV) Collection and assembly of data: S Gao, Y Zhou, R Yang, C Du; (V) Data analysis and interpretation: S Gao; (VI) Manuscript writing: All authors; (VII) Final approval of manuscript: All authors.

Correspondence to: Yihe Wu, PhD, MD. Department of Thoracic Surgery, The First Affiliated Hospital, Zhejiang University School of Medicine, No. 79 Qingchun Road, Hangzhou 310003, China. Email: drwuyihe@zju.edu.cn.

Background: Patients who undergo lung resection are at risk of postoperative cerebral infarction, but the risk factors remain unclear, so the present study was a comprehensive investigation in patients who underwent lung resection for pulmonary nodules.

Methods: The clinical characteristics of patients with postoperative cerebral infarction and patients who underwent lung resection on the same day but did not develop cerebral infarction were retrospectively compared. Univariate and multivariate logistic regression analyses were performed to identify the independent risk factors for cerebral infarction after lung resection.

Results: A total of 22 patients with postoperative cerebral infarction and 316 controls were included. Multivariate logistic regression analysis revealed that a history of cerebral infarction [odds ratio (OR), 7.289; P=0.030], activated partial thromboplastin time (APTT) <26.5 s (OR, 3.704; P=0.018), body mass index (BMI) ≥24.0 kg/m^2 (OR, 3.656; P=0.015), and surgical method (P=0.005) were independent risk factors for cerebral infarction after lung resection. Compared with patients undergoing lobectomy, the risk for postoperative cerebral infarction was significantly increased in patients undergoing segmentectomy (OR, 24.322; P=0.001), wedge resection (OR, 6.992; P=0.018), or combined surgical approach (OR, 29.921; P=0.028).

Conclusions: A history of cerebral infarction, APTT <26.5 s, BMI ≥24.0 kg/m^2, and surgical method were independent risk factors for cerebral infarction after lung resection. Strengthening thromboprophylaxis in patients with these risk factors may help to reduce the incidence of postoperative cerebral infarction.

Keywords: Cerebral infarction; lung resection; risk factors; thromboprophylaxis

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Introduction

Lung resection is the standard surgical method for pulmonary diseases such as pulmonary nodules and lung cancer. Despite improvements in surgical techniques and medical care, there are still many complications after lung resection. Postoperative cerebral infarction is one of the more uncommon but devastating complications, which imposes a heavy burden on patients and families. It has been reported that the incidence of postoperative cerebral infarction is 0.6–1.1% in patients after thoracic surgery (1). Several previous studies have suggested that old age, male sex, comorbidity, and left upper lobectomy are associated with postoperative cerebral infarction (2,3). To date, however, the pathogenesis of cerebral infarction after pulmonary surgery has not been elucidated clearly and, therefore, it has been difficult to relate this complication to some specific risk factors. Accordingly, further research into the reasons behind this complication is needed.

In this study, we conducted a case–control study to analyze the clinical features, treatments, and outcomes of lung resection in patients with postoperative cerebral infarction, in comparison with those without postoperative cerebral infarction, and to determine the possible risk factors. If the determined risk factors are reasonable enough to explain the causes of postoperative cerebral infarction, it will help us to identify high-risk patients and improve surgical safety. We present the following article in accordance with the STROBE reporting checklist (available at https://jtd.amegroups.com/article/view/10.21037/jtd-22-1019/rc).

Methods

Patient selection

The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by the Medical Ethics Committee of the First Affiliated Hospital, College of Medicine, Zhejiang University, Hangzhou, China (No. 2022-191), and individual consent was waived due to the retrospective nature of this study. Patients with postoperative cerebral infarction following lung resection during hospitalization between January 2015 and December 2021 were included as the case group and patients without postoperative cerebral infarction operated on the same day as the case group were selected as the control group. The inclusion criteria were patients who underwent lung resection for pulmonary nodules.

Highlight box

Key findings

- Four risk factors identified in the present study were strongly associated with postoperative cerebral infarction after lung resection.

What is known and what is new?

- Previous studies have suggested that old age, male sex, comorbidity, and left upper lobectomy are risk factors for postoperative cerebral infarction.
- Our research revealed that a history of cerebral infarction, APTT <26.5 s, BMI ≥24.0 kg/m2, and the surgical method are closely related to postoperative cerebral infarction.

What is the implication, and what should change now?

- These newly identified risk factors will help us to screen high-risk patients. Strengthening thromboprophylaxis in patients with these risk factors may help to reduce the incidence of postoperative cerebral infarction and improve perioperative safety.

Surgery and perioperative management

All patients underwent preoperative routine examinations including computed tomography (CT) of the chest, magnetic resonance imaging (MRI) of the brain, carotid ultrasound, echocardiography, electrocardiography (ECG), bronchoscopy, pulmonary function examination, and a series of blood examinations, etc. For those with pulmonary nodules with a high malignant tendency but the possibility of distant metastasis had been excluded, operation was then scheduled. On the day of surgery, patients were routinely given 500–1,000 mL crystalloid intravenously unless the operation was performed first. Minimally invasive surgery included video- or robotic-assisted thoracoscopic surgery. The pulmonary artery, pulmonary vein, bronchus, and pulmonary parenchyma were divided by linear staplers. All patients were given stretch socks to prevent thrombosis in the lower extremities during the perioperative period and subcutaneous low molecular weight heparin (LMWH) was administered on the second postoperative day to patients who were clinically considered as prone to thrombosis. All patients received continuous ECG monitoring during and after surgery. In addition, they all received postoperative prophylactic therapy with cephalosporins, antiemetic drugs, and fluid rehydration.

Variables and outcome of interest

Preoperative status and intraoperative information were abstracted retrospectively from the hospital medical records and operating room records for each patient as described in *Table 1* and *Table 2*. According to the Health Industry Standard of China: Adult Weight Determination (WS/T428-2013), body mass index (BMI) ≥24.0 kg/m^2 is considered overweight or obese. Based on this standard, BMI 24.0 kg/m^2 was used as the boundary for BMI grading. Surgical method was classified as lobectomy, segmentectomy, wedge resection, and combined surgical approach in our study. The combined surgical approach referred to combined lobectomy and segmentectomy, combined lobectomy and wedge resection, or combined segmentectomy and wedge resection. In this study, operation ranking referred to the order of operations in the same operating room on the same day.

The outcome of interest was cerebral infarction after

Table 1 Preoperative factors of patients with and without postoperative cerebral infarction by univariate analysis

Variable	Total (n=338)	Infarction (n=22)	Non-infarction (n=316)	P value
Age, (years)	60.0 (52.0–67.0)	55.5 (47.8–69.3)	61.0 (52.0–67.0)	0.338
Sex, n (%)				0.119
Male	146 (43.2)	6 (27.3)	140 (44.3)	
Female	192 (56.8)	16 (72.7)	176 (55.7)	
Body mass index grading, n (%)				0.047
≥24.0 kg/m^2	105 (31.1)	11 (50.0)	94 (29.7)	
<24.0 kg/m^2	233 (68.9)	11 (50.0)	222 (70.3)	
Smoking history, n (%)				0.354
Current or ever	90 (26.6)	4 (18.2)	86 (27.2)	
Never	248 (73.4)	18 (81.8)	230 (72.8)	
Comorbidity, n (%)				
Hypertension	99 (29.3)	8 (36.4)	91 (28.8)	0.451
Diabetes	21 (6.2)	2 (9.1)	19 (6.0)	0.637
Coronary heart disease	45 (13.3)	4 (18.2)	41 (13.0)	0.513
Sinus bradycardia	36 (10.7)	5 (22.7)	31 (9.8)	0.071
History of cerebral infarction	11 (3.3)	3 (13.6)	8 (2.5)	0.028
Carotid plaque	82 (24.3)	4 (18.2)	78 (24.7)	0.492
Anemia	47 (13.9)	6 (27.3)	41 (13.0)	0.101
Preoperative atrial fibrillation	4 (1.2)	0 (0)	4 (1.3)	1.000
Erythrocytes, (10^{12}/L)	4.52 (4.22–4.85)	4.44 (4.15–4.84)	4.53 (4.22–4.86)	0.611
Platelets, (10^9/L)	218.0 (181.5–256.3)	202.0 (179.5–253.3)	218.5 (180.5–256.8)	0.700
Albumin, (g/L)	45.9 (43.9–47.6)	45.8 (44.1–48.8)	45.9 (43.9–47.6)	0.814
APTT, (s)	26.7 (25.2–28.5)	26.1 (24.7–27.4)	26.7 (25.2–28.6)	0.096
APTT grading, n (%)				0.043
≥26.5 s	178 (52.7)	7 (31.8)	171 (54.1)	
<26.5 s	160 (47.3)	15 (68.2)	145 (45.9)	
TT, (s)	18.0 (17.4–18.6)	17.6 (16.8–18.3)	18.0 (17.4–18.6)	0.053
TT grading, n (%)				0.039
≥17.5 s	248 (73.4)	12 (54.5)	236 (74.7)	
<17.5 s	90 (26.6)	10 (45.5)	80 (25.3)	
PT, (s)	11.2 (10.7–11.6)	11.3 (11.0–11.8)	11.1 (10.7–11.6)	0.290
Fibrinogen, (g/L)	2.68 (2.38–3.14)	2.79 (2.30–3.58)	2.68 (2.38–3.13)	0.692

Values are presented as median, interquartile range, n, or n (%). APTT, Activated partial thromboplastin time; PT, prothrombin time; TT, thrombin time.

Table 2 Intraoperative factors of patients with and without postoperative cerebral infarction by univariate analysis

Variable	Total (n=338)	Infarction (n=22)	Non-infarction (n=316)	P value
Open or minimally invasive surgery, n (%)				1.000
Minimally invasive surgery (video- or robotic-assisted thoracoscopic surgery)	322 (95.3)	21 (95.5)	301 (95.3)	
thoracotomy	16 (4.7)	1 (4.5)	15 (4.7)	
Surgical site, n (%)				0.669
Left side	139 (41.1)	10 (45.5)	129 (40.8)	
Right side	199 (58.9)	12 (54.5)	187 (59.2)	
Surgical method, n (%)				0.002
Lobectomy	134 (39.6)	2 (9.1)	132 (41.8)	
Segmentectomy	34 (10.1)	6 (27.3)	28 (8.9)	
Wedge resection	145 (42.9)	12 (54.5)	133 (42.1)	
Combined surgical approach	25 (7.4)	2 (9.1)	23 (7.3)	
Surgical lobe, n (%)				0.029
Left upper	75 (22.2)	1 (4.5)	74 (23.4)	
Left lower	44 (13.0)	8 (36.4)	36 (11.4)	
Right upper	78 (23.1)	5 (22.7)	73 (23.1)	
Right middle	27 (8.0)	1 (4.5)	26 (8.2)	
Right lower	59 (17.4)	4 (18.2)	55 (17.4)	
Combined lobes	55 (16.3)	3 (13.6)	52 (16.5)	
Operation ranking, n (%)				0.284
First operation	74 (21.9)	7 (31.8)	67 (21.2)	
Subsequent operation	264 (78.1)	15 (68.2)	249 (78.8)	
Duration of operation grading, n (%)				0.197
<60 min	72 (21.3)	8 (36.4)	64 (20.3)	
60 to <120 min	175 (51.8)	10 (45.5)	165 (52.2)	
≥120 min	91 (26.9)	4 (18.2)	87 (27.5)	
Duration of anesthesia grading, n (%)				0.356
<90 min	75 (22.2)	7 (31.8)	68 (21.5)	
90 to <150 min	162 (47.9)	11 (50.0)	151 (47.8)	
≥150 min	101 (29.9)	4 (18.2)	97 (30.7)	
Histological type, n (%)				0.679
Malignant tumor	297 (87.9)	19 (86.4)	278 (88.0)	
Benign tumor	7 (2.1)	0 (0)	7 (2.2)	
Inflammatory pseudotumor or other	34 (10.0)	3 (13.6)	31 (9.8)	

Table 2 (*continued*)

Table 2 (*continued*)

Variable	Total (n=338)	Infarction (n=22)	Non-infarction (n=316)	P value
Total infusion of intraoperative fluids, (mL)	1,100.0 (1,000.0–1,500.0)	1,000.0 (1,000.0–1,312.5)	1,100.0 (1,000.0–1,500.0)	0.242
Crystalloid	1,000.0 (1,000.0–1,500.0)	1,000.0 (1,000.0–1,250.0)	1,000.0 (1,000.0–1,500.0)	0.646
Colloid	0 (0–0)	0 (0–0)	0 (0–0)	0.169
Blood	0	0	0	—
Intraoperative urine output, n (%)				0.434
<500 mL	254 (75.1)	18 (81.8)	236 (74.7)	
500 to <1,000 mL	56 (16.6)	4 (18.2)	52 (16.5)	
≥1,000 mL	28 (8.3)	0 (0)	28 (8.9)	
Intraoperative bleeding, n (%)				0.738
<50 mL	208 (61.5)	15 (68.2)	193 (61.1)	
50 to <100 mL	101 (29.9)	5 (22.7)	96 (30.4)	
≥100 mL	29 (8.6)	2 (9.1)	27 (8.5)	
Range of intraoperative mean arterial pressure fluctuation, (mmHg)	45.0 (35.8–53.0)	42.0 (35.8–50.0)	45.0 (35.3–53.0)	0.780
American society of anesthesiologists (ASA)physical status classification, n (%)				1.000
I	44 (13.0)	3 (13.6)	41 (13.0)	
II	286 (84.6)	19 (86.4)	267 (84.5)	
III	8 (2.4)	0 (0)	8 (2.5)	
Postoperative atrial fibrillation, n (%)	5 (1.5)	0 (0)	5 (1.6)	1.000

Values are presented as median, interquartile range, n, or n (%).

lung resection. All patients with suspicious symptoms of cerebral infarction after surgery underwent urgent CT perfusion imaging of the brain. The diagnosis of postoperative cerebral infarction was based on neurological deficits and evidence of acute cerebral infarction on neuroimaging (4).

Statistical analysis

Continuous data are presented as medians and interquartile ranges, and categorical data are presented as frequencies and percentages. A univariate analysis of potential risk factors was performed. For continuous variables, the Mann-Whitney U test was used to assess the differences between patients with and without postoperative cerebral infarction. Categorical variables were compared by the Chi-squared test or Fisher's exact test. Factors with a p-value <0.05 in the univariate analysis were entered into a multivariate logistic regression model. The correlation between different risk factors and postoperative cerebral infarction was determined using odds ratio (OR) and 95% confidence intervals (95% CI). All tests were two-sided and the value of $P<0.05$ was considered statistically significant. All statistical analyses were conducted using SPSS 25.0 (SPSS, Inc., Chicago, IL, USA).

Results

Patient selection and comparative univariate analysis

A total of 338 patients were enrolled in the present study, 22 of whom developed acute cerebral infarction after lung resection (6 men, 16 women). There were 316 patients without postoperative cerebral infarction operated on the same day corresponding to the case group (140 men, 176 women). Patients with postoperative cerebral infarction accounted for 6.5% (22/338) in the overall cohort, 1.5% (2/134) in the lobectomy, 17.6% (6/34) in the segmentectomy, 8.3% (12/145) in the wedge resection, and 8% (2/25) in the combined surgical approach groups. None of the 22 patients with postoperative cerebral infarction following lung resection had a history of preoperative or postoperative atrial fibrillation, none had received anticoagulation or antiplatelet therapies before surgery, and none underwent bi-lobectomy, pneumonectomy, or bronchial and pulmonary artery reconstruction. Additionally, the cerebral infarction in all patients occurred within 2 days after surgery, and in four cases it occurred with several hours after surgery. Despite aggressive treatment, such as thrombectomy or thrombolysis, 12 patients were still left with various sequelae and even severe dysfunction when they were discharged from the hospital. Details of the 22 patients with postoperative cerebral infarction are given in the Supplementary Material.

Preoperative and intraoperative factors were compared between the case and control groups. The results of the univariate analysis of potential risk factors are summarized in *Table 1* and *Table 2*. Compared with patients who had not developed postoperative cerebral infarction, those patients with postoperative cerebral infarction were a larger proportion with respect to overweight and obesity with a statistically significant difference (P=0.047): for the case group and the control group, the proportion of overweight or obesity was 50.0% and 29.7%, respectively. There were also statistical differences in the history of cerebral infarction: the proportion was 13.6% and 2.5%, respectively.

Patients in the case group had a shortened activated partial thromboplastin time (APTT, median, 26.1 s) and thrombin time (TT, median, 17.6 s), and the results for patients in the control group were 26.7 s and 18.0 s (P=0.096, P=0.053), respectively. After stratification of APTT and TT, there was a significant difference in the proportions of APTT <26.5 s and TT <17.5 s between the two groups (P=0.043, P=0.039, respectively). Furthermore, a statistically significant difference was also shown for surgical method (P=0.002) and surgical lobe (P=0.029).

Comparative multivariate analysis

In the multivariate analysis, BMI ≥24.0 kg/m^2, APTT <26.5 s, a history of cerebral infarction, and surgical method remained significantly associated with cerebral infarction after lung resection. Patients with a history of cerebral infarction were at a higher risk of postoperative cerebral infarction than those without a history of cerebral infarction (OR, 7.289; 95% CI, 1.207–44.036; P=0.030). In terms of surgical method, compared with patients who underwent lobectomy, the risk for postoperative cerebral infarction was significantly increased in patients who underwent segmentectomy (OR, 24.322; 95% CI, 3.937–150.245; P=0.001), or wedge resection (OR, 6.992; 95% CI, 1.398–34.974; P=0.018), or combined surgical approach (OR, 29.921; 95% CI, 1.452–616.522; P=0.028). In addition, BMI ≥24.0 kg/m^2 (OR, 3.656; 95% CI, 1.283–10.421; P=0.015) and APTT <26.5 s (OR, 3.704; 95% CI, 1.254–10.944; P=0.018) were also independent risk factors for cerebral infarction after lung resection (*Table 3*).

Discussion

Postoperative cerebral infarction often leads to adverse clinical outcomes. In spite of aggressive and effective treatments, and even unscheduled secondary surgery, some patients may be still left with varying degrees of disability, which has a significant impact on their quality of life (5). The purpose of our study was to identify the risk factors associated with this complication and thus better prevent its occurrence.

Among the four factors that we found were associated with postoperative cerebral infarction, surgical method was the most significant. Previous studies have demonstrated that left upper lobectomy is an independent risk factor for postoperative cerebral infarction when compared with other lobectomies due to longer pulmonary vein stumps and a higher incidence of thrombosis (3,6,7). In our study, however, none of the 22 patients with postoperative cerebral infarction underwent left upper lobectomy. In contrast, patients who underwent sublobar resection (segmentectomy or wedge resection) or combined surgical approach showed a higher incidence of cerebral infarction than those who underwent lobectomy (*Table 3*). Although lobectomy and lymph node dissection are standard procedures for lung cancer, many researchers have reported that sublobar resection is similar to standard lobectomy in terms of recurrence rate and 5-year survival rate among patients with early-stage, ground glass opacity-dominant non-small cell lung cancer (NSCLC) (8-10). Compared with lobectomy, sublobar resection has become an important procedure for small-sized NSCLC because of less trauma and better preservation of lung function (11). To our knowledge, however, there are few reports about the effect of sublobar resection on the occurrence of postoperative cerebral infarction. In our study, the proportion of patients with cerebral infarction after segmentectomy or wedge resection

Table 3 Multivariate logistic regression model for association with postoperative cerebral infarction

Variable	OR (95% CI)	P value
A history of cerebral infarction (yes *vs.* no)	7.289 (1.207–44.036)	0.030
APTT grading (<26.5 s *vs.* ≥26.5 s)	3.704 (1.254–10.944)	0.018
TT grading (<17.5 s *vs.* ≥17.5 s)	2.372 (0.826–6.810)	0.108
Body mass index grading (≥24.0 kg/m^2 *vs.* <24.0 kg/m^2)	3.656 (1.283–10.421)	0.015
Surgical methods		0.005
Lobectomy	1.000	
Segmentectomy	24.322 (3.937–150.245)	0.001
Wedge resection	6.992 (1.398–34.974)	0.018
Combined surgical approach	29.921 (1.452–616.522)	0.028
Segmentectomy *vs.* Wedge resection	3.478 (0.995–12.163)	0.051
Surgical lobes		0.082
Left upper lobe	1.000	
Left lower lobe	29.955 (2.555–351.251)	0.007
Right upper lobe	10.759 (0.933–124.100)	0.057
Right middle lobe	10.590 (0.480–233.543)	0.135
Right lower lobe	17.255 (1.369–217.418)	0.028
Combined lobe	3.548 (0.166–75.823)	0.418

CI, confidence interval; OR, odds ratio; APTT, activated partial thromboplastin time; TT, thrombin time.

was 27.3% and 54.5% respectively, which was much higher than that after lobectomy (9.1%). Segmentectomy is an anatomical resection. The division of the intersegmental plane by a linear stapler may leave a long intersegmental vein stump and damage the vascular endothelium (12), which may lead to postoperative thrombosis of the pulmonary vein stump. Wedge resection is a non-anatomical resection that, in contrast to lobectomy, may result in the formation of multiple and elongated pulmonary vein stumps away from the hilum. Similarly, damage to the vascular endothelium is inevitable during the process of wedge resection. All these factors might contribute to thrombosis and then embolism to the brain through the systemic circulation. It is no wonder that the combined surgical approach was more likely to result in postoperative cerebral infarction than simple lobectomy, because this surgical method involved either segmentectomy or wedge resection or both. Our study also demonstrated that postoperative cerebral infarction was more frequent with segmentectomy than with wedge resection (OR, 3.478; 95% CI, 0.995–12.163; P=0.051), although this difference did not retain statistical significance in the multivariate logistic regression analysis. This finding is somewhat consistent with previous studies that have found higher rates of complications with segmentectomy (13-15).

For patients scheduled for segmentectomy or wedge resection, preoperative assessment using a three-dimensional image reconstruction should be helpful. It may be as important as early postoperative anticoagulant therapy in preventing cerebral infarction within an extremely short period of time after surgery. Three-dimensional image reconstruction not only enables surgeons to better understand the anatomical location of the lesion and its relationship with adjacent tissues, thus avoiding the blind use of linear staplers, but also helps surgeons to clear visualize variations in the pulmonary vasculature, especially the intersegmental vein (16). We believe that this technique is a practical solution for safe and efficient surgical resection and avoidance of long residual pulmonary vein stumps.

APTT is an indispensable preoperative examination for patients and an indicator of the endogenous coagulation system. Habe *et al.* reported that a shortened APTT

(<26 s) is associated with thrombotic events and venous thromboembolism (VTE) in patients with connective tissue disease (17). In addition, Lin *et al.* reported that shortened APTT was a risk factor for ischemic stroke (18). The same phenomenon was observed in our study. That is, patients with postoperative cerebral infarction had a shorter APTT in the preoperative examination, which may indicate increased activity of coagulation factors. Lin *et al.* defined shortened APTT as <28.4 s (18). Based on our study, we suggest that APTT <26.5 s is more appropriate and sensitive as the cut-off value of shortened APTT. If the preoperative APTT value is <26.5 s, clinicians should be alert for the development of ischemic stroke during the perioperative period. According to these findings, three main factors leading to thrombosis (i.e., venous stasis, vascular injury, and hypercoagulability) (19) may all play an important role in the pathogenesis of postoperative cerebral infarction.

Additionally, we found that half of the patients with postoperative cerebral infarction were overweight or obese compared with only 29.7% of controls. Multivariate analysis also showed a significant association between overweight or obesity and postoperative cerebral infarction (OR, 3.656; 95% CI, 1.283–10.421; P=0.015). An accumulating body of research indicates that being overweight or obese has negative effects on health such as metabolic disorder and cardiovascular disease (20). Higher BMI has been associated with ischemic stroke (21,22). Similarly, being overweight or obese increases the difficulties of surgery, which may lead to an increase in perioperative complications (23). This may be attributed to obese patients being more predisposed to hemodynamic instability (24). Therefore, additional attention should be paid to perioperative management of overweight or obese patients.

In our study, no correlation was found between postoperative cerebral infarction and factors traditionally closely associated with cerebrovascular disease such as age and hypertension, which may be related to the increasing number of pulmonary nodules detected by physical examination in younger patients. The patient-related factor identified in our study as a risk factor of postoperative cerebral infarction was a history of cerebral infarction, which was consistent with previous reports (25). Therefore, the perioperative period may be especially dangerous for such patients and it is necessary to fully collect a preoperative medical history and inform patients of the surgical risks.

As a retrospective analysis, several limitations should not be ignored. First, this was a single-center study that included a relatively small number of patients. Additional confirmation of our findings in a larger sample size of patients in multiple centers would certainly be valuable. Second, patients with asymptomatic cerebral thromboembolism after surgery might be misclassified, because head CT or MRI examination was not routinely performed. Third, it is possible that information on other risk factors associated with postoperative cerebral infarction was not collected and analyzed in the present study.

Conclusions

Our study results showed that a history of cerebral infarction, APTT <26.5 s, BMI ≥ 24.0 kg/m^2, and surgical method were strongly associated with cerebral infarction after lung resection. Strengthening thromboprophylaxis in patients with these risk factors may help to reduce the incidence of postoperative cerebral infarction in lung resection patients. Moreover, given that cerebral infarction usually occurred in the early postoperative period, preoperative prophylactic anticoagulant therapy with LMWH is worth considering for those high-risk patients. Further elucidation of the mechanism of postoperative cerebral infarction is of great significance to improve the perioperative safety of patients.

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Footnote

Reporting Checklist: The authors have completed the STROBE reporting checklist. Available at https://jtd.amegroups.com/article/view/10.21037/jtd-22-1019/rc

Data Sharing Statement: Available at https://jtd.amegroups.com/article/view/10.21037/jtd-22-1019/dss

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://jtd.amegroups.com/article/view/10.21037/jtd-22-1019/coif). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by the Medical Ethics Committee of the First Affiliated Hospital, College of Medicine, Zhejiang University, Hangzhou, China (No. 2022–191), and individual consent was waived due to the retrospective nature of this study.

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